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EXAMINER

LAFORGIA, CHRISTIAN A

ART UNIT	PAPER NUMBER
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2131

18

DATE MAILED: 03/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

P24

Office Action Summary

Application No.

09/460,898

Applicant(s)

MATSUOKA ET AL.

Examiner

Christian La Forgia

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-40 is/are pending in the application.
- 4a) Of the above claim(s) 23 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22 and 24-40 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 03 March 2004 has been entered.

2. Claims 1 through 40 have been presented for examination.

3. Claim 23 has been cancelled as per Applicant's request.

Response to Arguments

4. Applicant's arguments filed 03 March 2004 have been fully considered but they are not persuasive.

5. Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references. The Applicant merely references that figure 43 of the instant application and figure 9 of the prior art have comparable structures of a Virtual Output Queue switch, yet fails to point out how they differ.

6. Applicant's arguments do not comply with 37 CFR 1.111(c) because they do not clearly point out the patentable novelty which he or she thinks the claims present in view of the state of the art disclosed by the references cited or the objections made. Further, they do not show how the amendments avoid such references or objections.

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7. Furthermore, the Applicant alleges that the prior art is different from the instant application, because the prior art realizes the scheduling in two steps using two kinds of pointers while the instant application realizes the scheduling in one step. It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the two steps of Chao into one step, since it has been held that forming into one step a method which has formerly been formed in several steps involves only routine skill in the art and is not enough to distinguish the instant application from the prior art. See MPEP § 2144.04; see also *In re Larson*, 340 F.2d 965, 967, 144 USPQ 347, 349 (CCPA 1965); *In re Wolfe*, 251 F.2d 854, 855, 116 USPQ 443, 444 (CCPA 1958).

8. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In this instance with regards to claims 1-16, 18-22, and 24-40, the Applicant argues only how Oba applies to the claim limitations, completely ignoring that Chao is the primary reference used in the 103 rejection. Concerning the Applicant's arguments that Oba does not teach determining an input line for a scheduling object using the inter highway pointer, and determining the VOQ in the input line using the intra-highway pointer by a round robin method, the Examiner respectfully draws the Applicant's attention to the Chao reference. The Examiner specifically refers to column 12, lines 38 through 51 of Chao as an example of where Chao discloses the claim limitations argued by the Applicant in their piecemeal analysis of the cited art.

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9. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., excluding the use of a complex algorithm to determine the VOQ in the input line) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

10. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, there is knowledge available to combine the reference generally available to one of ordinary skill in the art as illustrated by U.S. Patent Nos. 6,563,837; 6,359,861; 6,101,193; 5,689,644; and 5,926,458.

11. See further rejections that follow.

Claim Rejections - 35 USC § 103

12. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

13. Claims 1 through 16, 18 through 22, and 24 through 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chao, in view of United States Patent No. 6,262,986 to Oba et al., (hereinafter Oba).

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14. As per claim 1, Chao teaches a scheduling control system for a switch having a Virtual Output Queue comprising:

a request information management unit managing the number of scheduling request and holding forwarding request information of each input line as a scheduling target with respect to a desired output line (Figures 7a [block 714], 7b [block 714'], 8 [block 810, 840], 10 [blocks 1010, 1020, 1030, 1040], 11, 12 [blocks 1250, 1260, 1262, 1270], 13 [block 1270'], 15 [block 1520], 16 [blocks 1630, 1640], 17, 20a, 20b, 28, 37a, 37b, 37c; column 7, lines 33-44; column 8, lines 10-47; column 10, lines 27-50; column 12, lines 38-51; column 17, lines 22-29);

an inter-highway pointer control unit for indicating a start of scheduling input line (Figures 8, 9, 10 [blocks 1010, 1020, 1030, 1040], 11, 16 [blocks 1630, 1640], 17, 28, 33, 35a, 35b, 35c, 35d, 35e, 37c; column 8, line 48 to column 9, line 51; column 10, line 52 to column 11, line 47; column 16, lines 3-59; column 19, line 17 to column 20, line 20);

an intra-highway pointer control unit for indicating a start of retrieval output line in the forwarding request information corresponding to each input line (Figures 8, 9, 10 [blocks 1010, 1020, 1030, 1040], 11, 16 [blocks 1630, 1640], 17, 28, 33, 35a, 35b, 35c, 35d, 35e, 37c; column 8, line 48 to column 9, line 51; column 10, line 52 to column 11, line 47; column 16, lines 3-59; column 19, line 17 to column 20, line 20).

15. Chao does not teach a scheduling processing unit for starting the retrieval of the output lines from the output line indicated by the intra-highway pointer control unit according to the forwarding request information, selecting the output line unselected by other input lines, performing the scheduling for all the input lines in sequence starting from the input line indicated

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by the inter-highway pointer control unit, and updating each start-of-retrieval output line indicated by the intra-highway pointer control unit at a next scheduling cycle.

16. Oba teaches a scheduling processing unit for starting the retrieval of the output lines from the output line indicated by the intra-highway pointer control unit according to the forwarding request information, selecting the output line unselected by other input lines, performing the scheduling for all the input lines in sequence starting from the input line indicated by the inter-highway pointer control unit, and updating each start-of-retrieval output line indicated by the intra-highway pointer control unit at a next scheduling cycle (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 1 to column 10, line 3). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to include the scheduling processing unit of Oba with the system of Chao, as it would create a system in which all packets were dealt with fairly. One would be motivated to combine such a scheduling unit in the system of Chao as it would ensure that the use of bandwidth was being maximized as well as creating a method in which delivery was ensured via quality of service techniques as discussed both in Chao and Oba.

17. Regarding claim 2, Chao teaches a scheduling control system for a switch having a Virtual Output Queue comprising:

a request information management unit managing the number of scheduling requests and holding forwarding request information of each input line as a scheduling target with respect to a desired output line (Figures 7a [block 714], 7b [block 714'], 8 [block 810, 840], 10 [blocks 1010,

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1020, 1030, 1040], 11, 12 [blocks 1250, 1260, 1262, 1270], 13 [block 1270'], 15 [block 1520], 16 [blocks 1630, 1640], 17, 20a, 20b, 28, 37a, 37b, 37c; column 7, lines 33-44; column 8, lines 10-47; column 10, lines 27-50; column 12, lines 38-51; column 17, lines 22-29);

an inter-highway pointer control unit for indicating a start-of-scheduling output line (Figures 8, 9, 10 [blocks 1010, 1020, 1030, 1040], 11, 16 [blocks 1630, 1640], 17, 28, 33, 35a, 35b, 35c, 35d, 35e, 37c; column 8, line 48 to column 9, line 51; column 10, line 52 to column 11, line 47; column 16, lines 3-59; column 19, line 17 to column 20, line 20);

an intra-highway pointer control unit for indicating a start-of-retrieval input line in the forwarding request information corresponding to each input line (Figures 8, 9, 10 [blocks 1010, 1020, 1030, 1040], 11, 16 [blocks 1630, 1640], 17, 28, 33, 35a, 35b, 35c, 35d, 35e, 37c; column 8, line 48 to column 9, line 51; column 10, line 52 to column 11, line 47; column 16, lines 3-59; column 19, line 17 to column 20, line 20); and,

a scheduling processing unit for starting the retrieval of the input lines from the input line indicated by the intra-highway pointer control unit according to the forwarding request information, selecting the input line that is not ensured by other output lines, performing the scheduling for all the output lines in sequence starting from the output line indicated by the inter-highway pointer control unit, and updating each start-of-retrieval input line indicated by the intra-highway pointer control unit at a next scheduling cycle (Figures 8, 9, 10 [blocks 1010, 1020, 1030, 1040], 11, 16 [blocks 1630, 1640], 17, 28, 33, 35a, 35b, 35c, 35d, 35e, 37c; column 9, line 52 to column 10, line 27; column 10, line 52 to column 11, line 47; column 15, line 65 to column 16, line 59; column 20, lines 21-38).

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18. With regards to claim 3, Chao teaches the scheduling processing unit updates an inter-highway pointer to a next adjacent line per scheduling cycle, and updates an intra-highway pointer to a next line adjacent to the line with forwarding determined (Figures 10, 12, 13 [block 1270'], 19; column 12, lines 38-52; column 15, line 65 to column 16, line 53; column 17, line 66 to column 18, line 60; column 21, lines 49-65).

19. As per claim 4, Chao teaches the scheduling processing unit updates an inter-highway pointer to a line next to the line with the forwarding established at first within the scheduling cycle, and updates an intra-highway pointer to a next line adjacent to the line with the forwarding determined (Figures 10, 12, 13 [block 1270'], 19; column 12, lines 38-52; column 15, line 65 to column 16, line 53; column 17, line 66 to column 18, line 60; column 21, lines 49-65).

20. Regarding claim 5, Chao teaches the scheduling processing unit, if the request information exists in the line indicted by the intra-highway pointer and this line is used by other lines, does not update the intra-highway pointer (Figures 10, 12, 13 [block 1270'], 19; column 12, lines 38-52; column 15, line 65 to column 16, line 53; column 17, line 66 to column 18, line 60; column 21, lines 49-65).

21. Concerning claim 6, Chao teaches a scheduling control system for a switch having a Virtual Output Queue comprising:

a request information management unit managing the number of scheduling requests and holding forwarding request information on each input line as a scheduling target with respect to a

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desired output line (Figures 7a [block 714], 7b [block 714'], 8 [block 810, 840], 10 [blocks 1010, 1020, 1030, 1040], 11, 12 [blocks 1250, 1260, 1262, 1270], 13 [block 1270'], 15 [block 1520], 16 [blocks 1630, 1640], 17, 20a, 20b, 28, 37a, 37b, 37c; column 7, lines 33-44; column 8, lines 10-47; column 10, lines 27-50; column 12, lines 38-51; column 17, lines 22-29);

an inter-highway pointer control unit for holding an inter-highway pointer for indicating a start-of-scheduling input line (Figures 10, 12, 13 [block 1270'], 19; column 12, lines 38-52; column 15, line 65 to column 16, line 53; column 17, line 66 to column 18, line 60; column 21, lines 49-65);

an intra-highway pointer control unit for holding an intra-highway pointer for indicating a start-of-retrieval output line in the forwarding request information corresponding to each input line (Figures 10, 12, 15 [block 1520]; column 9, line 52 to column 10, line 27; column 16, lines 3-59);

a request management control unit for holding forwarding request information to a desired output line (Figures 10, 12, 15 [block 1520]; column 9, line 52 to column 10, line 27; column 16, lines 3-59); and,

22. Chao does not teach a scheduling processing unit for starting the retrieval of the output lines from the output line indicated by the intra-highway pointer control unit based upon plural pieces of the forwarding request information, and selecting the output line unselected by other input lines, and after finishing the scheduling, updating the inter-highway pointer to an adjacent line by alternately executing between a process of updating to an adjacent line in a forward direction per scheduling cycle, and a process of updating to an adjacent line in a reverse direction.

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23. Oba teaches a scheduling processing unit for starting the retrieval of the output lines from the output line indicated by the intra-highway pointer control unit based upon plural pieces of the forwarding request information, and selecting the output line unselected by other input lines, and after finishing the scheduling, updating the inter-highway pointer to an adjacent line by alternately executing between a process of updating to an adjacent line in a forward direction per scheduling cycle, and a process of updating to an adjacent line in a reverse direction (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 1 to column 10, line 3).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to include the scheduling processing unit of Oba with the system of Chao, as it would create a system in which all packets were dealt with fairly. One would be motivated to combine such a scheduling unit in the system of Chao as it would ensure that the use of bandwidth was being maximized as well as creating a method in which delivery was ensured via quality of service techniques as discussed both in Chao and Oba.

24. As per claim 7, Chao teaches the scheduling processing unit includes:

means for dividing, when selecting the forwarding request information corresponding to each line as a scheduling target, the forwarding request information into two pieces of information before and after the intra-highway pointer, and obtaining the lines having lowest numbers based on a low number selection logic from those pieces of information (Figures 10, 11, 13 [block 1320, 1330, 1350]; column 18, lines 27-60); and,

means for obtaining a final forwarding line number from the obtained two lower number lines with a priority given to a result after the intra-highway pointer (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52).

25. As per claim 8, Chao the scheduling processing units are provided, and the scheduling control system further comprises pipeline processing means for each independently executing pipeline process (Figure 13 [block 1320, 1330, 1350]; column 18, lines 27-60).

26. As per claim 9, Chao teaches a scheduling control system for a switch having a Virtual Output Queue comprising:

a request information management unit managing the number of scheduling requests and holding forwarding request information on each input line as a scheduling target with respect to a desired output line (Figures 7a [block 714], 7b [block 714'], 8 [block 810, 840], 10 [blocks 1010, 1020, 1030, 1040], 11, 12 [blocks 1250, 1260, 1262, 1270], 13 [block 1270'], 15 [block 1520], 16 [blocks 1630, 1640], 17, 20a, 20b, 28, 37a, 37b, 37c; column 7, lines 33-44; column 8, lines 10-47; column 10, lines 27-50; column 12, lines 38-51; column 17, lines 22-29);

an inter-highway pointer control unit for holding an inter-highway pointer for indicating a start-of-scheduling input line (Figures 10, 12, 13 [block 1270'], 19; column 12, lines 38-52; column 15, line 65 to column 16, line 53; column 17, line 66 to column 18, line 60; column 21, lines 49-65);

an intra-highway pointer control unit for holding an intra-highway pointer for indicating a start-of-retrieval output line in the forwarding request information corresponding to each input

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line (Figures 10, 12, 15 [block 1520]; column 9, line 52 to column 10, line 27; column 16, lines 3-59);

a request management control unit for holding forwarding request information to a desired output line (Figures 10, 12, 15 [block 1520]; column 9, line 52 to column 10, line 27; column 16, lines 3-59); and,

the intra-highway pointer control unit is independently controlled per the pipeline processing means (Figure 13 [block 1320, 1330, 1350]; column 18, lines 27-60).

27. Chao does not teach a plurality of scheduling processing units for starting the retrieval of the output lines from the output line indicated by the intra-highway pointer control unit from plural pieces of the forwarding request information, and selecting the output line unselected by other input lines;

wherein the plurality of scheduling processing units further include a plurality of pipeline processing means having inter-highway pointer with different start-of-scheduling line numbers and each independently executing a pipeline process.

28. Oba teaches a plurality of scheduling processing units for starting the retrieval of the output lines from the output line indicated by the intra-highway pointer control unit from plural pieces of the forwarding request information, and selecting the output line unselected by other input lines (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 1 to column 10, line 3);

wherein the plurality of scheduling processing units further include a plurality of pipeline processing means having inter-highway pointer with different start-of-scheduling line numbers

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and each independently executing a pipeline process (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 1 to column 10, line 3).

29. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to include the scheduling processing unit of Oba with the system of Chao, as it would create a system in which all packets were dealt with fairly. One would be motivated to combine such a scheduling unit in the system of Chao as it would ensure that the use of bandwidth was being maximized as well as creating a method in which delivery was ensured via quality of service techniques as discussed both in Chao and Oba. Additionally, one would also be motivated to implement multiple scheduling processing units as it would increase the speed and reliability of the switch, two areas that are of the utmost importance in networking. See *In re Harza*, 274 F.2d 669, 671, 124 USPQ 378, 380 (CCPA 1960).

30. As per claim 10, Chao teaches a scheduling control system comprising:

a request information management unit for holding forwarding request information on each input line as a scheduling target with respect to a desired output line (Figures 7a [block 714], 7b [block 714'], 8 [block 810, 840], 10 [blocks 1010, 1020, 1030, 1040], 11, 12 [blocks 1250, 1260, 1262, 1270], 13 [block 1270'], 15 [block 1520], 16 [blocks 1630, 1640], 17, 20a, 20b, 28, 37a, 37b, 37c; column 7, lines 33-44; column 8, lines 10-47; column 10, lines 27-50; column 12, lines 38-51; column 17, lines 22-29);

an inter-highway pointer control unit for holding an inter-highway pointer for indicating a start-of-scheduling input line (Figures 10, 12, 13 [block 1270'], 19; column 12, lines 38-52;

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column 15, line 65 to column 16, line 53; column 17, line 66 to column 18, line 60; column 21, lines 49-65);

an intra-highway pointer control unit for holding an intra-highway pointer for indicating a start-of-retrieval output line in the forwarding request information corresponding to each input line (Figures 10, 12, 15 [block 1520]; column 9, line 52 to column 10, line 27; column 16, lines 3-59);

a request management control unit for holding forwarding request information to a desired output line (Figures 10, 12, 15 [block 1520]; column 9, line 52 to column 10, line 27; column 16, lines 3-59); and,

31. Chao does not teach a scheduling processing unit for starting the retrieval of the output lines from the output line indicated by the intra-highway pointer control unit from plural pieces of the forwarding request information, and selecting the output line unselected by other input lines,

wherein the scheduling processing unit further includes a load observing unit for counting the number of packets arrived within a fixed cycle per logical forwarding request information of each input line, and performs the scheduling of a next cycle in accordance with the number of packets counted by the load observing unit.

32. Oba teaches a scheduling processing unit for starting the retrieval of the output lines from the output line indicated by the intra-highway pointer control unit from plural pieces of the forwarding request information, and selecting the output line unselected by other input lines (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks

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11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 1 to column 10, line 3),

wherein the scheduling processing unit further includes a load observing unit for counting the number of packets arrived within a fixed cycle per logical forwarding request information of each input line, and performs the scheduling of a next cycle in accordance with the number of packets counted by the load observing unit (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 49 to column 8, line 29; column 12, line 44 to column 13, line 25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the scheduling processing unit of Oba with the system of Chao, as it would create a system in which all packets were dealt with fairly. One would be motivated to combine such a scheduling unit in the system of Chao as it would ensure that the use of bandwidth was being maximized as well as creating a method in which delivery was ensured via quality of service techniques as discussed both in Chao and Oba.

33. Regarding claim 11, Chao teaches the scheduling processing unit restricts the number of forwarding permission packets to each output line within the fixed cycle, to the number of arrived packets to each piece of logical forwarding request information at the previous cycle (Figures 5, 8, 14e, 16, & 22a; column 20, lines 1-18; column 21, lines 28-49).

34. Concerning claim 12, Chao teaches the scheduling processing unit determines a rate for attaining a top priority output line in the scheduling within the fixed cycle in accordance with the

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number of arrived packets at the previous cycle (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52).

35. With regards to claim 13, Chao teaches the scheduling processing unit holds a top priority forwarding pointer, other than the intra-highway pointer, for determining the line for forwarding with a top priority in accordance with the number of arrived packets at the previous cycle, determines the output line in accordance with a rate of the number of arrived packets to each piece of the forwarding request information in accordance with the top priority forwarding pointer with respect to the number of all the arrived packets arrived at the input line at the previous cycle, and executes the scheduling with respect to those excluding the number of all the arrived packets in accordance with the normal intra-highway pointer (Figures 5, 8, 14e, 16, 22a, & 33; column 20, lines 1-18; column 21, lines 28-49; column 31, lines 20-48; column 31, line 51 to column 32, line 52).

36. As per claim 14, Chao teaches the scheduling processing unit executes, if the packets, of which the number is the same as the number of arrived packets at the previous cycle, are not forwarded within a present cycle, a process of carrying over a remaining number of arrived packets to the number of arrived packets at a next cycle (Figure 13 [blocks 1320, 1350, 1370], 36a, 36b, 36c; column 18, line 28 to column 19, line 12; column 31, line 51 to column 32, line 33).

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37. Regarding claim 15, Chao teaches the scheduling processing unit determines a rate for attaining a top priority output line in the scheduling within a fixed cycle in accordance with a forwarding request information length at the previous cycle (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52).

38. With regards to claim 16, Chao teaches wherein there are constructed extension units each including the scheduling processing unit per input line, two pieces of I/O ports, a selector unit for switching over an external I/O and an internal ring-connection, and a delay unit capable of changing a forwarding delay quantity to an extension output (Figures 8, 9, 12, 13 [blocks 1270', 1310, 1340, 1360], 14a-e, 22a-b, 32, 35a-e, 36a-c, 37a-c; column 12, line 52 to column 13, line 13; column 26, lines 22-38), and,

the extension units are ring-connected (Figures 22a-b; column 12, line 52 to column 13, line 13; column 26, lines 22-38).

39. As per claim 18, Chao does not teach a scheduling control system, wherein the scheduling processing unit further includes notifying means for notifying the buffer of a result of scheduling after the scheduling with respect to the first priority class and a buffer band control unit for controlling the band of the Quality of Service class within the line determined by the scheduler and performing delay priority control,

the buffer, if within a predetermined band of the Quality of Service class, accepts a result given from the scheduler and forwards data accumulated in the buffer, and, if out of the band,

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makes the forwarding request information thereof invalid and notifies the scheduler of this purport, and,

the scheduling processing unit thus performs a second scheduling.

40. Oba teaches a scheduling control system, wherein the scheduling processing unit further includes notifying means for notifying the buffer of a result of scheduling after the scheduling with respect to the first priority class and a buffer band control unit for controlling the band of the Quality of Service class within the line determined by the scheduler and performing delay priority control (Figures 7, 8A, 8B, 8C, & 8D; column 1, lines 19-55; column 11, line 22 to column 12, line 3; column 12, line 44 to column 13, line 25),

the buffer, if within a predetermined band of the Quality of Service class, accepts a result given from the scheduler and forwards data accumulated in the buffer, and, if out of the band, makes the forwarding request information thereof invalid and notifies the scheduler of this purport (Figures 7, 8A, 8B, 8C, & 8D; column 11, line 22 to column 12, line 3; column 12, line 44 to column 13, line 25), and,

the scheduling processing unit thus performs a second scheduling (Figures 7, 8A, 8B, 8C, & 8D; column 11, line 22 to column 12, line 3; column 12, line 44 to column 13, line 25). It would have been obvious to one of ordinary skill in the art to include the Quality of Service of Oba with the system of Chao because it would enable a system in which packets were guaranteed delivery. One would be motivated to include a quality of service system in that of the aforementioned system because it would create a method of checking the efficiency and reliability of the switch.

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41. Regarding claim 19, Chao teaches a switch having a Virtual Output Queue comprising:

an input buffer for controlling a band of the output line determined by the scheduler (column 10, line 51 to column 11, line 65; column 19, line 16 to column 20, line 20; column 21, line 49 to column 22, line 2);

a band control unit for executing delay and band control of each quality of service class in the output line having a forwarding right determined in the scheduling processing unit, reading packet-formatted data from the buffer if within a predetermined band, and, if out of the predetermined band, notifying the scheduler of a purport that the forwarding request information is invalid without outputting the packet-formatted data from the buffer (Figures 8, 9, 10 [blocks 1010, 1020, 1030, 1040], 11, 16 [blocks 1630, 1640], 17, 28, 33, 35a, 35b, 35c, 35d, 35e, 37c; column 9, line 52 to column 10, line 27; column 10, line 52 to column 11, line 47; column 15, line 65 to column 16, line 59; column 20, lines 21-38).

42. Chao does not teach means for notifying a scheduling processing unit of a quality of service class together with forwarding request information;

a scheduling processing unit having a scheduler for executing scheduling in order to determine an output line based on the forwarding request information.

43. Oba teaches means for notifying a scheduling processing unit of a quality of service class together with forwarding request information (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 49 to column 8, line 29; column 12, line 44 to column 13, line 25);

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a scheduling processing unit having a scheduler for executing scheduling in order to determine an output line based on the forwarding request information (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 49 to column 8, line 29; column 12, line 44 to column 13, line 25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the scheduling processing unit of Oba with the system of Chao, as it would create a system in which all packets were dealt with fairly. One would be motivated to combine such a scheduling unit in the system of Chao as it would ensure that the use of bandwidth was being maximized as well as creating a method in which delivery was ensured via quality of service techniques as discussed both in Chao and Oba.

44. As per claim 20, Chao teaches a packet device with a Virtual Output Queue comprising:
means for notifying a scheduling processing unit of a quality of service class together with forwarding request information (Figure 3a [block 306], 3b [block 328]; column 7, line 65 to column 8, line 9);

a scheduling processing unit for executing a scheduling process based on the forwarding request information on a first priority class of each input line in a first scheduling, and for executing, with an output line being unestablished in the first scheduling, the scheduling based on the request information on a second priority class (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52),

wherein the scheduling processing unit includes:

a scheduler for executing scheduling in an order to determine an output line based on the forwarding request information and performing the scheduling from a higher priority class among two or more classes (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52); and,

a buffer for controlling a band of the output line determined by the scheduler and intra-group band control (column 18, line 27 to column 20, line 38);

45. Chao does not teach wherein the scheduling processing unit further includes notifying means for notifying the buffer of a result of scheduling after the scheduling with respect to the first priority class and a buffer band control unit for controlling the band of the QoS class within the line determined by the scheduler and performing delay priority control;

the buffer, if within a predetermined band of the QoS class, accepts a result given from the scheduler and forwards data accumulated in the buffer, and, if out of band, makes the forwarding request information thereof invalid and notifies the scheduler of this purport, and the scheduling processing unit thus performs a second scheduling.

46. Oba teaches wherein the scheduling processing unit further includes notifying means for notifying the buffer of a result of scheduling after the scheduling with respect to the first priority class and a buffer band control unit for controlling the band of the QoS class within the line determined by the scheduler and performing delay priority control (Figures 3, 7, 8A, 8B, 8C, & 8D; column 7, line 49 to column 8, line 29; column 11, line 22 to column 12, line 3; column 12, line 44 to column 13, line 25);

the buffer, if within a predetermined band of the QoS class, accepts a result given from the scheduler and forwards data accumulated in the buffer, and, if out of band, makes the

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forwarding request information thereof invalid and notifies the scheduler of this purport (Figures 3, 7, 8A, 8B, 8C, & 8D; column 7, line 49 to column 8, line 29; column 11, line 22 to column 12, line 3; column 12, line 44 to column 13, line 25), and

the scheduling processing unit thus performs a second scheduling (Figures 7, 8A, 8B, 8C, & 8D; column 11, line 22 to column 12, line 3; column 12, line 44 to column 13, line 25). It would have been obvious to one of ordinary skill in the art to include the Quality of Service of Oba with the system of Chao because it would enable a system in which packets were guaranteed delivery. One would be motivated to include a quality of service system in that of the aforementioned system because it would create a method of checking the efficiency and reliability of the switch.

47. Regarding claim 21, Oba teaches wherein the scheduling processing unit gives a forwarding right to the forwarding request in an arbitrary off-band quality of service class if unable to obtain the forwarding right in any quality of service classes under the band control (Figures 3, 7, 8A, 8B, 8C, & 8D; column 7, line 49 to column 8, line 29; column 11, line 22 to column 12, line 3; column 12, line 44 to column 13, line 25).

48. With regards to claim 22, Chao teaches a switch having a Virtual Output Queue comprising:

a buffer, divided in logical output routes, for controlling a band of the output line determined by the scheduler (column 10, line 51 to column 11, line 65; column 19, line 16 to column 20, line 20; column 21, line 49 to column 22, line 2);

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49. Oba teaches an individual counter, provided per line or per quality of service class, for counting leaky buckets with respect to the output line selected by the scheduler (column 11, lines 26-58); and,

a representative counter, provided per line, including an internal timer and for counting an elapsed time since the output line has been selected last time (column 11, lines 26-58),

wherein each representative counter holds a time when the selection of the last time is made on the basis of the internal timer, and obtains the elapsed time by making a comparison with a present time when the selection is made next time (column 11, lines 26-58);

means for notifying a scheduling processing unit of a quality of service class together with forwarding request information (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 49 to column 8, line 29; column 12, line 44 to column 13, line 25);

a scheduling processing unit having a scheduler for executing scheduling in order to determine an output line based on the forwarding request information (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 49 to column 8, line 29; column 12, line 44 to column 13, line 25). It would have been obvious to one of ordinary skill in the art to include the Quality of Service of Oba with the system of Chao because it would enable a system in which packets were guaranteed delivery. One would be motivated to include a quality of service system in that of the aforementioned system because it would create a method of checking the efficiency and reliability of the switch.

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50. As per claim 24, Chao teaches a scheduling control system for a switch having a Virtual Output Queue comprising:

a request information management unit managing the number of scheduling requests and holding forwarding request information on each input line as a scheduling target with respect to a desired output line (Figures 7a [block 714], 7b [block 714'], 8 [block 810, 840], 10 [blocks 1010, 1020, 1030, 1040], 11, 12 [blocks 1250, 1260, 1262, 1270], 13 [block 1270'], 15 [block 1520], 16 [blocks 1630, 1640], 17, 20a, 20b, 28, 37a, 37b, 37c; column 7, lines 33-44; column 8, lines 10-47; column 10, lines 27-50; column 12, lines 38-51; column 17, lines 22-29);

a priority pointer control unit for indicating a start number of the priority patterns (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52),

wherein the scheduling processing unit sequentially performs the scheduling for the N-patterns from the priority pattern indicated by a priority pointer, and updates the start number of the priority patterns at a next scheduling cycle (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52).

51. Chao does not teach a scheduling processing unit, having N-pieces (N is a natural number equal to or more than 2) of priority patterns with different selection priorities between the respective output lines, for selecting the output line unused by other input lines in accordance the priority pattern and the forwarding request information.

52. Oba teaches a scheduling processing unit, having N-pieces (N is a natural number equal to or more than 2) of priority patterns with different selection priorities between the respective output lines, for selecting the output line unused by other input lines in accordance the priority pattern and the forwarding request information (Figures 1 [block 16], 2 [block 16], 3, 4, 5a

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[block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 49 to column 8, line 29; column 12, line 44 to column 13, line 25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the scheduling processing unit of Oba with the system of Chao, as it would create a system in which all packets were dealt with fairly. One would be motivated to combine such a scheduling unit in the system of Chao as it would ensure that the use of bandwidth was being maximized as well as creating a method in which delivery was ensured via quality of service techniques as discussed both in Chao and Oba.

53. As per claim 25, Chao teaches a scheduling control system for a switch having a Virtual Output Queue comprising:

a request information management unit managing the number of scheduling requests and holding forwarding request information on each input line as a scheduling target with respect to a desired output line (Figures 7a [block 714], 7b [block 714'], 8 [block 810, 840], 10 [blocks 1010, 1020, 1030, 1040], 11, 12 [blocks 1250, 1260, 1262, 1270], 13 [block 1270'], 15 [block 1520], 16 [blocks 1630, 1640], 17, 20a, 20b, 28, 37a, 37b, 37c; column 7, lines 33-44; column 8, lines 10-47; column 10, lines 27-50; column 12, lines 38-51; column 17, lines 22-29);

a priority pointer control unit for indicating a start number of the priority patterns (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52),

wherein the scheduling processing unit sequentially performs the scheduling for the N-patterns from the priority pattern indicated by a priority pointer, and updates the start number of

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the priority patterns at a next scheduling cycle (Figure 33; column 21, lines 22-48; column 30, lines 19-56; column 31, lines 20-48; column 31, line 51 to column 32, line 52).

54. Chao does not teach a scheduling processing unit, having N-pieces (N is a natural number equal to or more than 2) of priority patterns with different selection priorities between the respective output lines, for selecting the output line unused by other input lines in accordance the priority pattern and the forwarding request information.

55. Oba teaches a scheduling processing unit, having N-pieces (N is a natural number equal to or more than 2) of priority patterns with different selection priorities between the respective output lines, for selecting the output line unused by other input lines in accordance the priority pattern and the forwarding request information (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 49 to column 8, line 29; column 12, line 44 to column 13, line 25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the scheduling processing unit of Oba with the system of Chao, as it would create a system in which all packets were dealt with fairly. One would be motivated to combine such a scheduling unit in the system of Chao as it would ensure that the use of bandwidth was being maximized as well as creating a method in which delivery was ensured via quality of service techniques as discussed both in Chao and Oba.

56. Regarding claim 26, Chao does not teach wherein the scheduling processing unit applies a random array of inverted LSB/MSB binary notation permutation layout patterns as the above priority patterns.

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57. Oba teaches wherein the scheduling processing unit applies a random array of inverted LSB/MSB binary notation permutation layout patterns as the above priority patterns (Figures 7, 8A, 8B, 8C, & 8D; column 11, line 22 to column 12, line 3; column 12, line 44 to column 13, line 25). It would have been obvious to one of ordinary skill of the art at the time the invention was made to invert the binary notation of Oba as simply reversing or rearranging parts. See *In re Japikse*, 181 F.2d 1019, 1023, 86 USPQ 70, 73 (CCPA 1950).

58. With regards to claim 27, Chao teaches the scheduling processing unit includes means for selecting the forwarding line in accordance with the priority indicated by the priority pattern, and means for making a rotation of a combination of input line numbers and output line numbers which are different between the respective lines at every scheduling cycle (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52).

59. As per claim 28, Chao teaches the scheduling processing unit includes a scheduler for determining a selection candidate within a small group having a plurality of priority patterns with different selection priorities between all the lines, and an arrangement scheduler for arranging the candidates selected by the scheduler in accordance with the priorities between all the lines, and determining the final line (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52).

60. As per claim 29, Chao teaches a packet switch having a Virtual Output Queue comprising:

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sorters each serving as a unit sorter for sorting input cells coming from m-lines of input routes and transferring the sorted input cells to m-lines of output routes, the packet switch being constructed by connecting the unit sorters at multi-stages (Figures 18 & 32; column 20, line 38 to column 21, line 49; column 24, lines 7-48; column 24, line 64 to 26, line 20; column 28, lines 1-23),

wherein outputs per the unit sorter of a first-stage unit sorter group are outputted separately to a dummy sorter provided at a second stage and the unit sorter at the second stage (Figures 18 & 32; column 20, line 38 to column 21, line 49; column 24, lines 7-48; column 24, line 64 to 26, line 20; column 28, lines 1-23), and,

outputs of the second-stage dummy sorter and of the second-stage unit sorter are inputted to a third-stage unit sorter group (Figures 18 & 32; column 20, line 38 to column 21, line 49; column 24, lines 7-48; column 24, line 64 to 26, line 20; column 28, lines 1-23).

N-input/N-output sorter network is configured on the whole by connecting $(2N/m-1) * N/m$ pieces of the unit sorters (Figures 18 & 32; column 20, line 38 to column 21, line 49; column 24, lines 7-48; column 24, line 64 to 26, line 20; column 28, lines 1-23). See MPEP 716.01(a) concerning $(2N/m-1) * N/m$.

61. Regarding claim 30, Chao teaches a packet having a Virtual Output Queue comprising:

sorters each serving as a unit sorter for sorting input cells coming from m-lines of input routes and transferring the sorted input cells to N-lines of output routes, the packet switch being constructed by connecting the unit sorters at multi-stages in matrix X- and Y-directions (Figures

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18 & 32; column 20, line 38 to column 21, line 49; column 24, lines 7-48; column 24, line 64 to 26, line 20; column 28, lines 1-23);

wherein outputs of the respective unit sorters are inputted to next-stage unit sorters positioned in (+)X- and (-)Y-directions of the unit sorter (Figures 18 & 32; column 20, line 38 to column 21, line 49; column 24, lines 7-48; column 24, line 64 to 26, line 20; column 28, lines 1-23),

when extending the sorter group, the outputs of the respective unit sorters are inputted next-stage unit sorters positioned in the (+)X-direction of the unit sorter (Figures 18 & 32; column 20, line 38 to column 21, line 49; column 24, lines 7-48; column 24, line 64 to column 26, line 20; column 28, lines 1-23), and

an N-input/N-output sorter network is configured on the whole by connecting $N/m * (N/m + 1) / 2$ pieces of the unit sorters (Figures 18 & 32; column 20, line 38 to column 21, line 49; column 24, lines 7-48; column 24, line 64 to 26, line 20; column 28, lines 1-23). See MPEP 716.01(a) concerning $(2N/m - 1) * N/m$.

62. As per claim 31, Chao teaches a packet switch having a Virtual Output Queue comprising:

a request information management unit managing the number of scheduling requests and holding forwarding request information on each input line as a scheduling target with respect to a desired output line (Figures 7a [block 714], 7b [block 714'], 8 [block 810, 840], 10 [blocks 1010, 1020, 1030, 1040], 11, 12 [blocks 1250, 1260, 1262, 1270], 13 [block 1270'], 15 [block 1520],

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16 [blocks 1630, 1640], 17, 20a, 20b, 28, 37a, 37b, 37c; column 7, lines 33-44; column 8, lines 10-47; column 10, lines 27-50; column 12, lines 38-51; column 17, lines 22-29);

an inter-highway pointer control unit for holding an inter-highway pointer for indicating a start-of-scheduling input line (Figures 10, 12, 13 [block 1270'], 19; column 12, lines 38-52; column 15, line 65 to column 16, line 53; column 17, line 66 to column 18, line 60; column 21, lines 49-65);

an intra-highway pointer control unit for holding an intra-highway pointer for indicating a start-of-retrieval output line in the forwarding request information corresponding to each input line (Figures 10, 12, 15 [block 1520]; column 9, line 52 to column 10, line 27; column 16, lines 3-59);

a request management control unit for holding forwarding request information to a desired output line (Figures 10, 12, 15 [block 1520]; column 9, line 52 to column 10, line 27; column 16, lines 3-59).

63. Chao does not teach a scheduling processing unit for starting the retrieval of the output lines from the output line indicated by the intra-highway pointer control unit from plural pieces of the forwarding request information, and selecting the output line unselected by other input lines,

wherein the scheduling processing unit, after allocating the output line numbers to valid cells coming from the respective input lines, allocates dummy output line numbers for idle cells to the input lines to which the valid cells are not allocated, and transfers the output line numbers of the cells coming from all the input lines with different values without any overlaps.

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64. Oba teaches a scheduling processing unit for starting the retrieval of the output lines from the output line indicated by the intra-highway pointer control unit from plural pieces of the forwarding request information, and selecting the output line unselected by other input lines, (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 49 to column 8, line 29; column 12, line 44 to column 13, line 25),

wherein the scheduling processing unit, after allocating the output line numbers to valid cells coming from the respective input lines, allocates dummy output line numbers for idle cells to the input lines to which the valid cells are not allocated, and transfers the output line numbers of the cells coming from all the input lines with different values without any overlaps (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 49 to column 8, line 29; column 12, line 44 to column 13, line 25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the scheduling processing unit of Oba with the system of Chao, as it would create a system in which all packets were dealt with fairly. One would be motivated to combine such a scheduling unit in the system of Chao as it would ensure that the use of bandwidth was being maximized as well as creating a method in which delivery was ensured via quality of service techniques as discussed both in Chao and Oba.

65. As per claim 32, Chao teaches a packet switch having a Virtual Output Queue comprising:

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a request information management unit managing the number of scheduling requests and holding forwarding request information on each input line as a scheduling target with respect to a desired output line (Figures 7a [block 714], 7b [block 714'], 8 [block 810, 840], 10 [blocks 1010, 1020, 1030, 1040], 11, 12 [blocks 1250, 1260, 1262, 1270], 13 [block 1270'], 15 [block 1520], 16 [blocks 1630, 1640], 17, 20a, 20b, 28, 37a, 37b, 37c; column 7, lines 33-44; column 8, lines 10-47; column 10, lines 27-50; column 12, lines 38-51; column 17, lines 22-29);

a priority pointer control unit for indicating a start number of the priority patterns (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52).

66. Chao does not teach a scheduling processing unit, having N-pieces (N is a natural number equal to or more than 2) of priority patterns with different selection priorities between the respective output lines, for selecting the output line unused by other input lines in accordance with the priority pattern and the forwarding request information (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52); and,

wherein the scheduling processing unit, sequentially performing the scheduling for the N-patterns from the priority pattern indicated by a priority pointer, and updating the start number of the priority patterns at a next scheduling cycle, simultaneously allocates the output line numbers to the valid cells coming from the respective input lines and allocates dummy output line numbers to idle cells by effecting contention control, and transfers the output line numbers of the cells coming from all the input lines with different values without any overlaps.

67. Oba teaches a scheduling processing unit, having N-pieces (N is a natural number equal to or more than 2) of priority patterns with different selection priorities between the respective output lines, for selecting the output line unused by other input lines in accordance with the

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priority pattern and the forwarding request information (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 49 to column 8, line 29; column 12, line 44 to column 13, line 25); and,

wherein the scheduling processing unit, sequentially performing the scheduling for the N-patterns from the priority pattern indicated by a priority pointer, and updating the start number of the priority patterns at a next scheduling cycle, simultaneously allocates the output line numbers to the valid cells coming from the respective input lines and allocates dummy output line numbers to idle cells by effecting contention control, and transfers the output line numbers of the cells coming from all the input lines with different values without any overlaps (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 49 to column 8, line 29; column 12, line 44 to column 13, line 25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the scheduling processing unit of Oba with the system of Chao, as it would create a system in which all packets were dealt with fairly. One would be motivated to combine such a scheduling unit in the system of Chao as it would ensure that the use of bandwidth was being maximized as well as creating a method in which delivery was ensured via quality of service techniques as discussed both in Chao and Oba.

68. Regarding claim 33, Chao teaches a packet switching method for a switch having a Virtual Output Queue comprising the steps of:

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imparting a sequence number to a phase-synchronization-oriented cell transferred from each input line (Figure 13 [blocks 1320, 1350, 1370], 36a, 36b, 36c; column 18, line 28 to column 19, line 12; column 31, line 51 to column 32, line 33);

sequentially incrementing the output line number (Figure 13 [blocks 1320, 1350, 1370], 36a, 36b, 36c; column 18, line 28 to column 19, line 12; column 31, line 51 to column 32, line 33);

shifting the output line number at the same timing between the respective input lines (Figure 13 [blocks 1320, 1350, 1370], 36a, 36b, 36c; column 18, line 28 to column 19, line 12; column 31, line 51 to column 32, line 33); and,

executing phase synchronization at a cell level by comparing a timing of receiving the phase-synchronization-oriented cell with the sequence number at each lattice point on the switch side (Figure 13 [blocks 1320, 1350, 1370], 36a, 36b, 36c; column 18, line 28 to column 19, line 12; column 31, line 51 to column 32, line 33).

69. Chao does not teach in a scheduling process of updating an inter-highway pointer indicating a start-of-scheduling input line to a next adjacent input line at every scheduling cycle, and updating an intra-highway pointer indicating a start-of-retrieval output line to a line adjacent to the line with the forwarding determined on the basis of forwarding request information corresponding to the input line.

70. Oba teaches in a scheduling process of updating an inter-highway pointer indicating a start-of-scheduling input line to a next adjacent input line at every scheduling cycle, and updating an intra-highway pointer indicating a start-of-retrieval output line to a line adjacent to the line with the forwarding determined on the basis of forwarding request information

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corresponding to the input line (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 1 to column 10, line 3). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to include the scheduling processing unit of Oba with the system of Chao, as it would create a system in which all packets were dealt with fairly. One would be motivated to combine such a scheduling unit in the system of Chao as it would ensure that the use of bandwidth was being maximized as well as creating a method in which delivery was ensured via quality of service techniques as discussed both in Chao and Oba.

71. As per claim 34, Chao teaches a packet switching method for a switch having a Virtual Output Queue comprising the steps of:

transferring in broadcast the cells given the sequence numbers to respective lattice points within the switch from the respective input lines (Figure 13 [blocks 1320, 1350, 1370], 36a, 36b, 36c; column 18, line 28 to column 19, line 12; column 31, line 51 to column 32, line 33); and,

executing phase synchronization at a cell level by comparing the sequence numbers of the arrived cells at the lattice points within the switch (Figure 13 [blocks 1320, 1350, 1370], 36a, 36b, 36c; column 18, line 28 to column 19, line 12; column 31, line 51 to column 32, line 33).

72. Chao does not teach a scheduling process of updating an inter-highway pointer indicating a start-of-scheduling input line to a next adjacent input line at every scheduling cycle, and updating an intra-highway point indicating a start-of-retrieval output line to a line adjacent to the line with the forwarding determined on the basis of forwarding request information corresponding to the input line.

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73. Oba teaches in a scheduling process of updating an inter-highway pointer indicating a start-of-scheduling input line to a next adjacent input line at every scheduling cycle, and updating an intra-highway point indicating a start-of-retrieval output line to a line adjacent to the line with the forwarding determined on the basis of forwarding request information corresponding to the input line (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 1 to column 10, line 3). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to include the scheduling processing unit of Oba with the system of Chao, as it would create a system in which all packets were dealt with fairly. One would be motivated to combine such a scheduling unit in the system of Chao as it would ensure that the use of bandwidth was being maximized as well as creating a method in which delivery was ensured via quality of service techniques as discussed both in Chao and Oba.

74. With regards to claim 35, Chao teaches a packet switching method for a switch having a Virtual Output Queue comprising the steps of:

transferring the cells to the respective lattice points within the switch from the input lines (Figure 13 [blocks 1320, 1350, 1370], 36a, 36b, 36c; column 18, line 28 to column 19, line 12; column 31, line 51 to column 32, line 33); and,

adjusting a phase difference at a cell level by a phase adjustment buffer provided at each lattice point (Figure 13 [blocks 1320, 1350, 1370], 36a, 36b, 36c; column 18, line 28 to column 19, line 12; column 31, line 51 to column 32, line 33).

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75. Chao does not teach in a scheduling process of updating an inter-highway pointer indicating a start-of-scheduling input line to a net adjacent input line at every scheduling cycle, and updating an intra-highway pointer indicating a start-of-retrieval output line to a line adjacent to the line with the forwarding determined on the basis of forwarding request information corresponding to the input lines.

76. Oba teaches in a scheduling process of updating an inter-highway pointer indicating a start-of-scheduling input line to a net adjacent input line at every scheduling cycle, and updating an intra-highway pointer indicating a start-of-retrieval output line to a line adjacent to the line with the forwarding determined on the basis of forwarding request information corresponding to the input lines (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 1 to column 10, line 3). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to include the scheduling processing unit of Oba with the system of Chao, as it would create a system in which all packets were dealt with fairly. One would be motivated to combine such a scheduling unit in the system of Chao as it would ensure that the use of bandwidth was being maximized as well as creating a method in which delivery was ensured via quality of service techniques as discussed both in Chao and Oba.

77. Regarding claim 36, Chao teaches wherein the scheduling processing unit includes:

means for dividing, when selecting the forwarding request information corresponding to each line as a scheduling target, the forwarding request information into two pieces of information before and after the intra-highway pointer, and obtaining the lines having lowest

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numbers based on a low number selection logic from those pieces of information (Figures 10, 11, 13 [block 1320, 1330, 1350]; column 18, lines 27-60); and,

means for obtaining a final forwarding line number from the obtained two lower number lines with a priority given to a result after the intra-highway pointer (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52).

78. Regarding claim 37, Chao teaches wherein a plurality of the scheduling processing units are provided, and the scheduling control system further comprises pipeline processing means for each independently executing a pipeline process (Figure 13 [block 1320, 1330, 1350]; column 18, lines 27-60).

79. Regarding claim 38, Chao does not teach wherein the scheduling processing unit gives a forwarding right to the forwarding request in an arbitrary off-band QoS class if unable to obtain the forwarding right in any QoS classes under the band control.

80. Oba teaches wherein the scheduling processing unit gives a forwarding right to the forwarding request in an arbitrary off-band QoS class if unable to obtain the forwarding right in any QoS classes under the band control (Figures 7, 8A, 8B, 8C, & 8D; column 11, line 22 to column 12, line 3; column 12, line 44 to column 13, line 25).

81. Regarding claim 39, Chao does not teach wherein the scheduling processing unit applies a random array of inverted LSB/MSB of binary notation permutation layout patterns as the above priority patterns.

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82. Oba teaches wherein the scheduling processing unit applies a random array of inverted LSB/MSB of binary notation permutation layout patterns as the above priority patterns (Figures 7, 8A, 8B, 8C, & 8D; column 11, line 22 to column 12, line 3; column 12, line 44 to column 13, line 25). It would have been obvious to one of ordinary skill of the art at the time the invention was made to invert the binary notation of Oba as simply reversing or rearranging parts. See *In re Japikse*, 181 F.2d 1019, 1023, 86 USPQ 70, 73 (CCPA 1950).

83. As per claim 40, Chao teaches a scheduling control system for a switch having a Virtual Output Queue comprising:

a request information management unit holding forwarding request information for each input line as a scheduling target with respect to a desired output line (Figures 7a [block 714], 7b [block 714'], 8 [block 810, 840], 10 [blocks 1010, 1020, 1030, 1040], 11, 12 [blocks 1250, 1260, 1262, 1270], 13 [block 1270'], 15 [block 1520], 16 [blocks 1630, 1640], 17, 20a, 20b, 28, 37a, 37b, 37c; column 7, lines 33-44; column 8, lines 10-47; column 10, lines 27-50; column 12, lines 38-51; column 17, lines 22-29);

an inter-highway pointer control unit for indicating a start-of-scheduling input line for a scheduling cycle (Figures 8, 9, 10 [blocks 1010, 1020, 1030, 1040], 11, 16 [blocks 1630, 1640], 17, 28, 33, 35a, 35b, 35c, 35d, 35e, 37c; column 8, line 48 to column 9, line 51; column 10, line 52 to column 11, line 47; column 16, lines 3-59; column 19, line 17 to column 20, line 20);

an intra-highway point control unit for indicating, for each input line, a start-of-retrieval output line in the forwarding request information (Figures 8, 9, 10 [blocks 1010, 1020, 1030, 1040], 11, 16 [blocks 1630, 1640], 17, 28, 33, 35a, 35b, 35c, 35d, 35e, 37c; column 8, line 48 to

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column 9, line 51; column 10, line 52 to column 11, line 47; column 16, lines 3-59; column 19, line 17 to column 20, line 20).

84. Chao does not teach a scheduling processing unit for starting the scheduling cycle according to the start-of-scheduling input line and retrieving output lines, for each input line, starting from the start-of-retrieval output line, the scheduling processing unit scheduling output lines based upon the forwarding request information for each input line and selecting the output line unselected by other input lines, performing the scheduling for all the input lines in sequence, and updating each start-of-retrieval output line indicated by the intra-highway pointer control unit at a next scheduling cycle.

85. Oba teaches a scheduling processing unit for starting the scheduling cycle according to the start-of-scheduling input line and retrieving output lines, for each input line, starting from the start-of-retrieval output line, the scheduling processing unit scheduling output lines based upon the forwarding request information for each input line and selecting the output line unselected by other input lines, performing the scheduling for all the input lines in sequence, and updating each start-of-retrieval output line indicated by the intra-highway pointer control unit at a next scheduling cycle (Figures 1 [block 16], 2 [block 16], 3, 4, 5a [block 16], 5b [block 16], 8a-d [block 16], 10 [blocks 11-1, 11-2, 11-N], 13; column 4, line 62 to column 6, line 53; column 7, line 49 to column 8, line 29; column 12, line 44 to column 13, line 25). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the scheduling processing unit of Oba with the system of Chao, as it would create a system in which all packets were dealt with fairly. One would be motivated to combine such a scheduling unit in the system of Chao as it would ensure that the use of bandwidth was being maximized as well as

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creating a method in which delivery was ensured via quality of service techniques as discussed both in Chao and Oba.

86. Claim 17 is rejected under 35 U.S.C. 103(a) as being obvious over U.S. Patent No. 6,449,283 to Chao et al., hereinafter Chao.

87. As per claim 17, Chao teaches a scheduling control system for a switch having a Virtual Output Queue comprising:

means for notifying a scheduling processing unit of a quality of service class together with forwarding request information (Figure 3a [block 306], 3b [block 328]; column 7, line 65 to column 8, line 9);

a scheduling processing unit for executing a scheduling process based on the forwarding request information on a first priority class of each input line in a first scheduling, and for executing, with an output line being unestablished in the first scheduling, the scheduling based on the request information on a second priority class (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52),

wherein the scheduling processing unit includes:

a scheduler for managing the number of scheduling requests and performing the scheduling from a higher priority class among two or more classes (Figure 33; column 31, lines 20-48; column 31, line 51 to column 32, line 52); and

a buffer for executing band control of the output line determined by the scheduler and intra-group band control (column 9, line 52 to column 10, line 26; column 10, line 52 to column 11, line 23; column 20, lines 21-63). Chao teaches the scheduling is performed in two steps. It

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would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the two steps of Chao into one step, since it has been held that forming into one step a method which has formerly been formed in several steps involves only routine skill in the art and is not enough to distinguish the instant application from the prior art. See MPEP § 2144.04; see also *In re Larson*, 340 F.2d 965, 967, 144 USPQ 347, 349 (CCPA 1965); *In re Wolfe*, 251 F.2d 854, 855, 116 USPQ 443, 444 (CCPA 1958).

Conclusion

88. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

89. The following patents are cited to further show the state of the art with respect to virtual output queue switches, such as:

United States Patent No. 6,677,984 to Chao et al., which is cited to show a method for arbitrating output port contention in a switch having virtual output queuing.

United States Patent No. 6,614,790 to Veres et al., which is cited to show architecture for integrated services packet-switched networks.

United States Patent No. 6,654,374 to Fawaz et al., which is cited to show a apparatus to reduce jitter in packet switched networks.

United States Patent No. 6,480,911 to Lu, which is cited to show grouping class sensitive queues.

United States Patent No. 5,956,342 to Manning et al., which is cited to show priority arbitration for point-to-point and multipoint transmissions.

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90. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christian La Forgia whose telephone number is (703) 305-7704.

The examiner can normally be reached on Monday thru Thursday 7-5.

91. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ayaz Sheikh can be reached on (703) 305-9648. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

92. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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